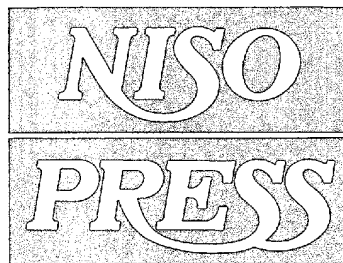American National Standard

Scientific and Technical Reports — Elements, Organization, and Design

NISO

PRESS

Bethesda, Maryland, U.S.A.

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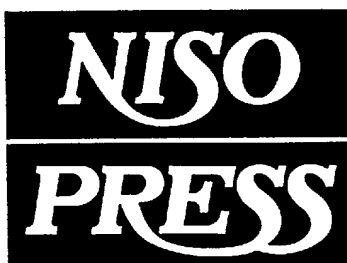FAX: 301-567-9553

ANSI/NISO Z39.18-1995
(Revision of ANSI Z39.18-1987)

ISSN: 1041-5653

Scientific and Technical Reports — Elements, Organization, and Design

Abstract: To facilitate information retrieval, the elements, organization, and design of scientific and technical reports are outlined. Guidance in organizing the required and optional elements of the three major sections (front matter, text, and back matter) is provided. The standard establishes guidelines for the uniform presentation of visual and tabular matter, formatting, and pagination. Additional suggestions for presenting numbers, formulas, equations, symbols, abbreviations, and acronyms are included.

An American National Standard
Developed by the
National Information Standards Organization
Approved March 21, 1995 by the
American National Standards Institute

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∞ This paper meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).

Contents

(continued)

(Contents continued)

Foreword

(This Foreword is not a part of the American National Standard for Scientific and Technical Reports — Elements, Organization, and Design, ANSI/NISO Z39.18-1995. It is included for information only.)

This standard presents guidelines about the elements, organization, and design of scientific and technical reports. Its purpose is to foster uniformity in such reports for ease of information retrieval while permitting diversity of purpose, scope, and subject matter. The standard does not provide guidance on other typical technical information products such as journal articles, proposals, technical specifications, or technical and consumer manuals. This publication is a standard rather than a report and, therefore, does not follow in every particular the report format prescribed. Moreover, the language of the standard is couched in the indicative rather than the subjunctive mood ("is," not "shall" or "must") which is typically used in standards.

In the development of this standard, Committee AH examined existing practices and conventions from a wide variety of organizations, institutions, and associations, as reflected in the annotated bibliography (Appendix A). These sources were chosen because they represent a variety of report producers and are available to the report-producing public. Where practices varied, committee members resolved the differences based on their collective experiences. Where appropriate, they have recommended options to accommodate the widely varied needs of report producers. Because of this variety, not all the elements described are mandatory for a report although the placement and sequence of report elements should be consistent. For example, federal agencies use a report documentation page, but many academic and industrial report producers do not. The use and placement of report documentation pages are considered optional by the standard to accommodate local practices, therefore instructions for preparing them are given in Appendix B.

The standard provides explicit guidance about the bibliographic data elements that appear on the covers and title pages (and, if they are used, report documentation pages) of reports if the reports are printed or presented in image form. Compliance with these guidelines ensures thorough, consistent, and uniform bibliographic description, and control of data essential to libraries, abstracting services, and other technical information organizations that acquire, store, and provide access to information resources.

The standard also describes the scope of each section of a report and offers principles for the effective communication of textual, visual, and tabular material. The establishment of technical writing standards is beyond the scope of this standard; however, the standard does provide an extensive annotated bibliography of books about technical writing and language usage and style (Appendix A).

The standard includes basic requirements for publication formats; the use of figures and tables; and the presentation of numbers and units, formulas and equations, and symbols, abbreviations, and acronyms. It does not, however, offer specific advice about electronic publishing systems that enable users to design and produce reports using a computer, appropriate software, and a laser or laser-quality printer. Because report production and reproduction techniques use rapidly changing software products that are beyond the scope of this standard, they are not specified. Most software packages for page and report production do provide instruction manuals for users, however. The author(s) or other individuals charged with preparing a report should plan to deliver both a paper copy and an electronic version available on diskette, CD-ROM, or network services.

The standard supports the electronic publication of hard (paper) copy while acknowledging that reports are also produced, stored, and retrieved in electronic formats. Paper and electronic documents have different design constraints, however, that are not easily reconciled in a single standard. Insofar as it is possible to do so, this standard establishes a *de facto* document-type definition (DTD), a set of rules for establishing the structure of reports, that may be electronically processed through systems that include document imaging, optical character recognition, compression/decompression, and optical media storage of full text.

Suggestions for improving this standard are welcome. They should be sent to the National Information Standards Organization, P.O. Box 1056, Bethesda, MD 20827, telephone (301) 654-2512.

This standard was processed and approved for submittal to ANSI by the National Information Standards Organization. NISO approval of this standard does not necessarily imply that all Voting Members voted for its approval. As the time it approved this standard, NISO had the following members:

FOREWORD   ANSI/NISO Z39.18-1995

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FOREWORD

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Acknowledgements

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ANSI/NISO Z39.18-1995

Scientific and Technical Reports — Elements, Organization, and Design

1. General Information

1.1 Purpose and Scope of Standard

This standard establishes guidelines for the elements, organization, and design of scientific and technical reports. The standard fosters uniformity in such reports, while allowing for diversity of subject matter, purpose, and audience. Because this publication is a standard rather than a report, it follows the ANSI-approved format for published standards rather than the prescribed report format.

1.2 Definition of Scientific and Technical Reports

Scientific and technical reports (hereafter referred to as "reports") convey the results of basic or applied research and support decisions based on those results. A report includes the ancillary information necessary for interpreting, applying, and replicating the results or techniques of an investigation. The primary purposes of such a report are to disseminate the results of scientific and technical research and to recommend action.

A report has a unique, issuer-supplied report number and may have a contract or grant number and an accession or acquisition number. A report also exhibits some or all of the following characteristics:

1. Its readership may be limited, its distribution may be limited or restricted, and its contents may include classified, proprietary, or copyrighted information.

2. It may be written for an individual or organization as a contractual requirement to recount a total research story, including full discussions of unsuccessful approaches.

3. It is not usually published or made available through commercial publishing; it is often available through a non-profit governmental entity (for example, the National Technical Information Service or the Government Printing Office).

2. Referenced Standards

2.1 American National Standards

This standard is intended for use in conjunction with the following American National Standards. When these standards are superseded by a revision approved by the American National Standards Institute, consult the revision.

ANSI Z39.4-1984, *Basic Criteria for Indexes*

ANSI Z39.14-1979 (R1986), *Writing Abstracts*

ANSI/NISO Z39.23-1990, *Standard Technical Report Number (STRN) Format and Creation*

ANSI Z39.29-1977, *Bibliographic References*

ANSI/NISO Z39.48-1992, *Permanence of Paper for Printed Publications and Documents in Libraries and Archives*

ANSI/NISO Z39.72-199X, *Format for Submission of Data for Multimedia CD-ROM Mastering* (draft standard)

ANSI/IEEE 268-1982 (R1992), *Metric Practice*

NISO/ANSI/ISO 9660, *Volume and File Structure of CD-ROM for Information Exchange*

NISO/ANSI/ISO 12083, *Electronic Manuscript Preparation and Markup*

2.2 Other Standards

In addition to ANSI standards, the following standards provide useful information for preparing reports:

ASTM E 380-1991, *Standard Practice for Use of the International System of Units (SI) (The Modernized Metric System)*

Federal Information Processing Standards Publication 152, 1988, Standard Generalized Markup Language

Federal Information Processing Standards Publication 29-2, Interpretation Procedures for Federal Information Processing Standards for Software

ISO 8879:1986, *Information Processing—Text and Office Systems—Standard Generalized Markup Language*

ISO 9069:1987, *Information Processing—SGML Support Facilities—SGML Document Interchange Format (SDIF)*

ISO 9070:1987, *SGML Support Facilities—Registration Procedure for Public Text*

ISO/IEC 10744:1992, *International Standard for Hypermedia/Time-Based Structuring Language (HyTime)*

ISO/IEC 11172:1993, *(MP) International Standard for Information Technology, Coding of Moving Pictures and Associated Audio for Digital Storage Media*

2.3 Other Publications

The following publications provide additional useful information for preparing reports.

The Chicago Manual of Style, 14th ed., Chicago, IL: University of Chicago Press, 1993.

Swanson, Ellen. *Mathematics into Type: Copyediting and Proofreading of Mathematics for Editorial Assistants and Authors*. Rev. ed. Providence, RI: American Mathematical Society, 1979.

U.S. Government Printing Office. *Style Manual*. Rev. ed. GPO S/N 2100-0068. Washington, DC: U.S. Government Printing Office, 1984.

Weast, Robert C. et al. (eds.). *CRC Handbook of Chemistry and Physics: A Ready-Reference Book of Chemical and Physical Data*, 71st ed. Boca Raton, FL: CRC Press, 1994.

3. Elements of Reports

A report contains three major sections: front matter, text (also called body), and back matter. Each section contains individual elements that vary according to the subject matter and length of the report. Each major division is part of a whole and is consistent with the other major divisions in style and appearance.

Table 1 presents the appropriate sequence of the front matter, text, and back matter. Other topical headings and subheadings, particularly in the text (body) of a report, depend on the subject and scope of the report.

4. Organization of Reports

This section provides guidance on organizing the required and optional elements of a report.

4.1 Front Matter

Front matter consists of all materials preceding the text and serves several purposes: to give the reader a general idea of the purpose and scope of the report; to provide background about or a context for the report; and to list where in the report the reader can find specific chapters, headings, figures, and tables. It also provides information that is needed for cataloging the report for bibliographic databases. A discussion of the purpose and scope of each element of front matter follows.

4.1.1 Cover

Although considered an optional element of front matter, a cover provides physical protection for the printed version of a report. A cover identifies the report number, the title, the author(s), and any distribution limitations of a report. If classified or proprietary information appears in a report, a notice on the cover indicates that such material is included. The required data elements of a report cover are:

1. Report number
2. Report title and subtitle, if one is used
3. Title and numbering of series, if the report is issued in a series
4. Author, principal investigator, editor, and/or compiler
5. Publisher (the sponsoring organization that assumes responsibility for publication of a report)
6. Date of publication
7. Distribution limitations.

Legal or policy concerns of the sponsoring organization may require the use of additional data elements.

4.1.2 Title Page

The required title page provides information needed for the description and bibliographic control of and access to a report. These data are critical to libraries, abstracting services, and other organizations that acquire, store, and provide access to information resources. If the performing and sponsoring organizations are different entities, the title page clearly identifies the different responsibilities (that is, performance and sponsorship). The information on the cover and title page is consistent; if an optional report documentation page is used, the bibliographic data there are also consistent with the information on the cover and title page. The required data elements of a title page are:

1. Report number
2. Report title and subtitle, if one is used
3. Title and numbering of series, if the report is issued in a series
4. Author, principal investigator, editor, and/or compiler
5. Performing organization (author affiliation)
6. Publication data, including place of publication, publisher (sponsoring organization), and date

Table 1. Report elements			
Major Section	**Required Elements**	**Optional Elements**	**Explanatory Comment**
FRONT MATTER		Cover	protects printed report
	Title Page		provides information for description and bibliographic control
	Notices		used on cover and title page to call attention to restrictions or limitations on distribution
		Report Documentation Page	used by federal agencies for database building
	Abstract		briefly informs of purpose, scope, and findings
	Table of Contents		outlines organization and scope of a report
	List(s) of Figures and Tables		required for 5 or more figures or tables or any combination thereof; optional for fewer than 5
		Foreword	provides background or context for a report
		Preface	announces purpose and scope; acknowledges contributions of non-authors
		Acknowledgments	used if acknowledgments are too lengthy to present in preface
TEXT (BODY)	Summary		summarizes problem, results, conclusions, recommendations
	Introduction		states subject, purpose, scope and plan for developing report
	Methods, Assumptions, and Procedures		describes research methodology
	Results and Discussion		presents findings and discusses their significance
	Conclusions		presents substantiated findings, discusses their implications, and presents author's opinion
		Recommendations	suggests a course of action
	References		cites sources of information used by author(s) of report
BACK MATTER		Appendixes	contain supplemental information not essential to the text
		Bibliography	lists additional sources of information not cited in the text of a report
	List(s) of Symbols, Abbreviations, and Acronyms		used to explain the meaning of symbols, abbreviations, and acronyms; needed if there are more than 5 not readily recognized as standard
		Glossary	defines and explains unfamiliar terms
		Index	lists major topics alphabetically; not required in reports of fewer than 50 pages
		Distribution List	gives permanent record of initial distribution of a report

7. Type of report and period covered, where applicable
8. Contract or grant number, where applicable
9. Sponsoring or issuing organization (if different from the performing organization)

Figures 1a and 1b show a sample cover and title page of a report for which the performing and sponsoring organizations are the same. Figures 2a and 2b show a sample cover and title page for which the performing and sponsoring organizations are different. Legal or policy concerns of the organization for which a report is prepared may require the use of additional data elements on these pages.

4.1.2.1 Report Number
Each report requires a unique report number that appears in an upper corner on both the cover and title page (and on the spine of a bound report if space permits so that the user will not have to remove the report from a shelf to read the number). A report number is composed of an alphanumeric report code (2-16 characters) and a numeric sequential group (1-14 digits indicating the year and sequence of report issuance). Different sponsoring and performing organizations usually assign separate report numbers; hence, a document may have multiple report numbers. These numbers are stacked in an upper corner of both the cover and title page and at the top of the spine, if practical. ANSI/NISO Z39.23-1990 provides guidance on establishing and using standard scientific and technical report numbers.

4.1.2.2 Title and Subtitle
The title is especially important in abstracting, cataloging, indexing, and referencing a report and for informing potential readers of the content. The words of the title define and limit the topic of the report and appear on the cover, title page, and optional report documentation page in exactly the same language. In creating the title of a report, an author
1. Selects words that distinguish the report from any other on the same general topic rather than writing "Report on . . ."
2. Uses a distinctive subtitle for clarity if the report is one in a series or a supplement to previously published work. Information about the period covered by the report (for example, month, quarter, or year) is included in the subtitle of reports in series.
3. Spells out abbreviations and acronyms. When a report consists of more than one volume (or binding), the title is repeated on a separate title page, and each separate volume is identified by

an arabic number and a volume title or subtitle (for example, Interstellar and Interplanetary Dust: Volume 2, Supernova Isotopic Enrichments).

4.1.2.3 Authorship
The authorship of a report is reserved for the person or persons who originated the scientific or technical information or the text of the report, and who can effectively defend the content of the report to a peer group. The primary author is always identified first. Identifying an editor is justified when the editor has applied subject matter expertise in preparing the report.

An author's name appears on the cover and title page and, if one is used, the report documentation page, in identical form. The preferred order is first name, middle name or initial, followed by surname. Academic degrees are not given. However, authors or contributors can identify themselves by their job titles in the organization (Jane R. Doe, Cost Analyst; Jack T. Doe, Head, Research and Development Division) or by their functions as contributors to the report (Jane R. Doe, Principal Investigator; Jack T. Doe, Compiler). In cases of multiple authorship, the names of the authors and editors appear under their organizational affiliation.

4.1.2.4 Performing and Sponsoring Organizations
The performing organization conducts research; the sponsoring organization funds research and usually controls report publication and distribution. The performing organization and the sponsoring organization may be one and the same. Reports that present the results of research done under contracts or grants identify both a performing and a sponsoring organization. In such cases, the name of the sponsoring organization, the performing organization, or other responsible unit, and the complete address(es) appear on the title page. If there are multiple sponsoring organizations, each is listed, and the functions of each are identified.

4.1.3 Notices
When it is necessary to call attention to certain aspects of a report, such as its security classification, restricted distribution, or proprietary information, appropriate notices appear on the cover and title page. For example, a notice may alert the reader that a particular report is:
1. A presentation of preliminary findings, subject to revisions
2. A formal draft or a working paper intended to elicit comments and ideas

Page 4

Figure 1a: Sample cover, performing and sponsoring organizations are the same

Carderock Division
Naval Surface Warfare Center
Bethesda, MD 20084-5000

CARDIVNSWC–TR—93/013 December 1993
Machinery Research and Development Directorate
Technical Report

DD 21A—A Capable, Affordable, Modular 21st Century Destroyer
by
William J. Levedahl, Samuel R. Shank, and William P. O'Reagan

Approved for public release; distribution is unlimited.

DD 21A—A Capable, Affordable, Modular 21st Century Destroyer

CARDIVNSWC–TR—93/013

Figure 1b: Sample title page, performing and sponsoring organizations are the same

Carderock Division
Naval Surface Warfare Center
Bethesda, MD 20084-5000

CARDIVNSWC–TR—93/013 December 1993
Machinery Research and Development Directorate
Technical Report

DD 21A—A Capable, Affordable, Modular 21st Century Destroyer
by
William J. Levedahl, Samuel R. Shank, and William P. O'Reagan

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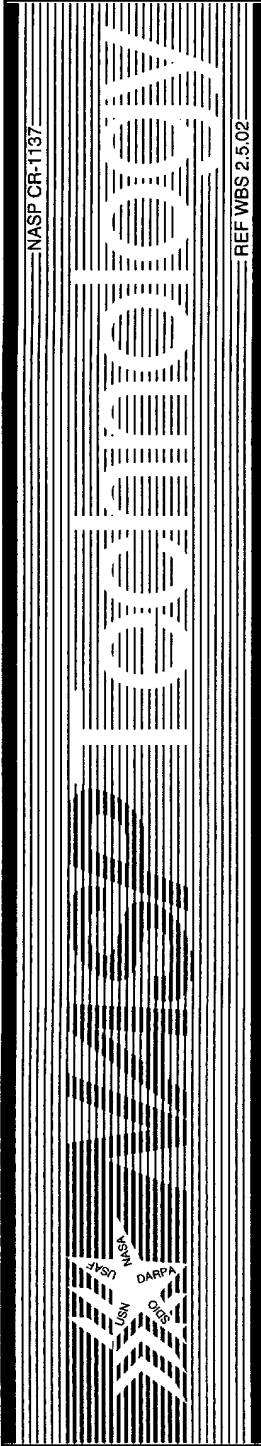Figure 2a: Sample cover, performing and sponsoring organizations are different

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NASP Contractor Report 1137

Damping of Thermal Acoustic Oscillations in Hydrogen Systems

Youfan Gu and Klaus D. Timmerhaus

Grant NAG3-1018

September 1992

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Figure 2b: Sample title page, performing and sponsoring organizations are different

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NASP Contractor Report 1137
REF WBS 2.5.02

Damping of Thermal Acoustic Oscillations in Hydrogen Systems

Youfan Gu and Klaus D. Timmerhaus

Department of Chemical Engineering
University of Colorado
Boulder, Colorado

Prepared for
NASA Lewis Research Center
under Grant NAG3-1018

Printed by
NASA Langley Research Center

September 1992

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3. A preprint of a report to be presented at a professional meeting.

Figure 3 shows a sample cover with a notice of restricted distribution.

If disclaimers or similar notices are needed, they appear on the inside front cover of a printed report. Notices may also alert the reader to certain legal conditions, for example, the use of brand or trade names. Generic terms are preferable to brand or trade names if scientific or technical accuracy can be maintained using such terms. A disclaimer may or may not be appropriate for government-generated reports. It is the responsibility of each organization to determine the appropriate notice for the publications that it produces, and to coordinate any such decisions with the appropriate legal counsel.[1]

Copyrights on reports are not always formally registered, and material prepared for the U.S. Government is usually available for public dissemination without copyright. For those reports that are copyrighted, U.S. Copyright Law specifies that the copyright notice appear "on the title page or the page immediately following" and consist of the word "copyright" or the copyright symbol "©" accompanied by the year of copyright and the name of the copyright proprietor. The order of appearance is not important so long as all three elements appear. The recommended location is the verso (back) of the title page.

4.1.4 Report Documentation Page

Agencies within the federal government use a report documentation page (for example, a National Technical Information Service bibliographic data sheet or Standard Form 298) in addition to a title page. A report documentation page is an optional element, however, for academic and industrial reports.

Figure 4 shows a sample completed report documentation page containing all pertinent bibliographic data about the report (including key words or identifiers) necessary for librarians, information specialists, and others concerned with information processing and handling. An abstract of 200 words or fewer is an integral part of this page. Some federal agencies require that reports prepared for them under contract or grant contain a report documentation page and specify its location in the report. Academic and industrial report producers that use a report documentation page frequently place it as the final element of back matter. A report documentation page is not listed in the table of contents unless it appears as back matter; however, it is paginated whether it appears as front or back matter. Instructions for completing a report documentation page appear in Appendix A of this standard.

4.1.5 Abstract

An abstract, a required element of front matter, presents a concise, informative statement (approximately 200 words) of the purpose, scope, methods, and major findings of the report, including results, conclusions, and recommendations. The informative abstract retains the tone and scope of the report but omits the details. The abstract typically appears on a separate page between the title page and the table of contents although reports that use a report documentation page in the front matter include the abstract as bibliographic data entered on the form. Because abstracts are also published by abstracting services to assist potential readers in determining whether they may be interested in the report, an abstract is understandable independent of the rest of the report. An abstract contains no undefined symbols, abbreviations, or acronyms and makes no reference by number to references or illustrative material. ANSI Z39.14-1979 (R1986), the standard guide for preparing informative abstracts, provides examples of abstracts as well as guidance on the presentation and style of abstracts.

4.1.6 Table of Contents

The required table of contents identifies the heading and beginning page number of each major section of the front matter (excluding the title page and the table of contents), the text, and the back matter. A table of contents page helps readers understand the organization and

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[1] For example, the following disclaimer appears on the inside front cover of each contractor report prepared under U.S. Government sponsorship:

"This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government, nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof."

Figure 3: Sample cover with a notice of restricted distribution

NASA Technical Memorandum 4490

Highlights of NASA Swept Supercritical Wing Experiments With Laminar-Flow Control

W. Don Harvey

NOTICE

FOR EARLY DOMESTIC DISSEMINATION

Because of its significant early commercial potential, this information, which has been developed under a U.S. Government program, is being disseminated within the United States in advance of general publication. This information may be duplicated and used by the recipient with the express limitation that it not be published. Release of this information to other domestic parties by the recipient shall be made subject to these limitations.

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Date for general release   February 28, 1996

February 1994

Figure 4: Sample of a completed report documentation page

REPORT DOCUMENTATION PAGE		Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE May 1993	3. REPORT TYPE AND DATES COVERED Scientific Report No. 5

4. TITLE AND SUBTITLE	5. FUNDING NUMBERS
Upgraded Line-of-Sight Geometry Package and Band model Parameters for MODTRAN	C – F19628-89-C-0128 PE – 62101F PR – 3054
6. AUTHOR(S) P. K. Acharya, D. C. Robertson, and A. Berk	TA – 02 WU – AJ

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBERS
Spectral Sciences, Inc. 99 South Bedford Street, #7 Burlington, MA 01803-5169	

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSORING / MONITORING AGENCY REPORT NUMBER
Phillips Laboratory 29 Randolph Road Hanscom AFB, MA 01731-3010 Contract Manager: Dean Kimball/GPOS	PL-TR-93-2127

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT	12b. DISTRIBUTION CODE
Approved for Public Release; Distribution Unlimited.	

13. ABSTRACT *(Maximum 200 words)*

The MODTRAN atmospheric transmittance and radiance code was upgraded with new band model parameters calculated using the HITRAN-92 line atlas. The (1/d) band model parameters for O_3 were adjusted to give better agreement with the corresponding line-by-line FASCOD3 calculations for long paths in the 20-50 km altitude region. More accurate line-of-sight (LOS) geometry routines were incorporated for greater consistency between the geometry parameters. Furthermore, MODTRAN can now handle very short slant paths down to 0.001 km.

14. SUBJECT TERMS		15. NUMBER OF PAGES 22
Band Model Parameters Ozone Transmittance Refracted	LOWTRAN MODTRAN FASCOD3	16. PRICE CODE

17. SECURITY CLASSIFICATION UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT SAR

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI/NISO Std. Z39.18
298-102

scope of a report. Headings in the table of contents are numbered, worded, spelled, and punctuated exactly as they are in the report. Because a table of contents outlines and provides location of information, each level of heading(s) has at least two entries to follow accepted outline format. Figure 5 shows a sample table of contents page.

Figure 5: Sample table of contents page

Contents

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In the table of contents it is useful to include a list of subheadings at the beginning of each major report section that is more than 20 pages in length. Subheadings are also helpful for the understanding of complex material; however, not all levels of headings need be listed. For example, first- and second-level headings might suffice. If any heading of a given level is listed, however, all headings of that level are included in the section table of contents. (See also 5.4, Pagination for an explanation of page numbering.)

4.1.7 List(s) of Figures and Tables
If a report contains more than five figures or five tables or some combination totaling more than five, a list of figures or tables is required. If a report contains fewer than five figures or tables, a list is optional. The lists of figures and tables, titled "Figures" and "Tables" respectively, follow the contents page. If the table of contents fills only half a page, the lists of figures and tables may follow the table of contents on the same page. If lists of figures and tables are included in a report, all figures and tables are listed with their corresponding page numbers. A list of figures precedes a list of tables. If a report has many figures and few tables or few figures and many tables, they can be combined into a single list ("Figures and Tables") with the figures preceding the tables.

4.1.8 Foreword
The foreword is an optional introductory statement that presents background material or that places in context a report that is part of a series. It is written by an authority in the field other than the author of the report. The name and affiliation of the author of the foreword follow the last paragraph. A foreword and a preface are not interchangeable, and the information in them is not redundant. A foreword precedes a preface, if both are included.

4.1.9 Preface
A preface is an optional introductory statement that announces the purpose and scope of the report and acknowledges the contributions of individuals not identified as authors or editors. Sometimes a preface specifies the audience for whom a report is intended; it may also highlight the relationship of the report to a specific project or program. Material that is necessary for understanding the report belongs in the introduction, not in the preface.[2]

A preface is usually written by the author, the editor, or other party responsible for the report. The author's name and affiliation do not appear at the end of the preface unless there might be doubt about its authorship. The preface follows the required contents page, lists of figures and tables, and optional foreword and begins on a separate page titled "Preface."

4.1.10 Acknowledgments
Acknowledgments of technical assistance that contributed to the content of the report are made at an appropriate place in the preface or in the text; however, lengthy acknowledgments are often made in a special optional section titled "Acknowledgments." This optional section follows the preface, in which case the preface does not contain acknowledgments. If there is no preface, "Acknowledgments" follows the contents page (or lists of figures and tables and foreword).

4.2 Text (Body) Matter
The text is the part of the report in which the author describes methods, assumptions, and procedures; presents and discusses the results; and draws conclusions and recommends actions based on those results.

The organization of a report depends on its subject matter and audience as well as on its purpose. Thus, the organization of the text may vary widely from report to report. Information on the content of text elements follows.

4.2.1 Summary
A summary is a required element of the text of a report. It clearly states the key points of the report, including the problem under investigation, the principal results, and conclusions, and recommends a course of action for decision makers. The summary differs from an abstract in purpose, audience, and length. Because the summary restates key points, material not included in the text does not appear in the summary. Introductory material (purpose, scope, limitations), descriptive material (nature and method of investigation), and the most important results and conclusions are summarized with emphasis on the findings of the research

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[2] Administrative information is used in lieu of a preface in certain U.S. Department of Defense technical reports. Administrative information indicates the authorization (sponsor) for the work and all funding levels through the work unit level. The program element, task area, and work unit numbers are usually required; other relevant information or program information is also provided here.

and recommendations. The length of the summary typically does not exceed 2 percent of the body of the report.

Although a summary depends on the text in that it introduces no new information, it is independent of the text from the reader's point of view; therefore, all symbols, abbreviations, and acronyms are defined and unusual terms are explained. A summary does not contain references.

If a report exceeds 50 pages in length, a separate executive summary is often prepared for a management-level audience. An executive summary is a nontechnical presentation that provides an adequate level of detail for decision makers who need a basic understanding of a research problem and the major findings but who do not plan to read the report in its entirety.

4.2.2 Introduction

The required introduction provides readers with general information that they need to understand more detailed information in the rest of the report. It introduces the subject, the purpose, the scope, and the way the author plans to develop the topic. The introduction also indicates the audience for the report: who is expected to read it and act on its recommendations or review its findings. The introduction does not, however, include findings, conclusions, or recommendations.

The statement of the subject defines the topic and associated terminology and may include the theory behind the subject, its historical background, and its significance. The statement of the purpose indicates the reason for the investigation; the statement of the scope indicates the extent and limits of the investigation. The author's plan for developing the report usually presents a narrative outline of the text.

4.2.3 Methods, Assumptions, and Procedures

The methods, assumptions, and procedures used in an investigation are succinctly described so that readers can evaluate the results without referring extensively to the references. The description is complete enough that a knowledgeable reader could duplicate the procedures of the investigation. The system of measurement (for example, metric or English) is identified. If the research included apparatus, instruments, or reagents, a description of the apparatus, the design and precision of the instruments, and the nature of the reagents are explained in this required section of text. (See also 5.5, Units and Numbers.)

4.2.4 Results and Discussion

A required element of the report text, results and their discussion are presented in the same or in separate sections. The discussion section indicates the degree of accuracy and the significance of the results of the research described in a report. Specific values used to substantiate conclusions appear in the text. Supporting details not essential to an understanding of the results appear in an appendix. Sometimes a section, "Presentation of Results," includes figures and tables and their captions (titles). Such figures and tables appear as close as possible following their discussion in the text. (See also 5.2, Visual and Tabular Matter.)

4.2.5 Conclusions

The required conclusions section interprets findings that have been substantiated in the discussion of results and discusses their implications. The section introduces no new material other than remarks based on these findings. It includes the author's opinions. The conclusions section is written so that it can be read independently of the text. One of the following examples may be an appropriate title for this section:
1. Conclusions — if deductions independent of specific conditions of the investigation are made
2. Restatement of Results — if factual findings specific to the particular investigation are given
3. Concluding Remarks — if opinions are included in addition to findings and conclusions.

4.2.6 Recommendations

The optional recommendations section presents a course of action based on the results of the study. Types of studies for which recommendations are often made include tests and experiments, field trials, specific design problems, feasibility studies, and market appraisals. Recommendations might include additional areas for study, alternate design approaches, or production decisions. Specific recommendations are presented in a numbered or bulleted list that is introduced by an informative, lead-in sentence.

4.2.7 References

The references section appears as the last section of the text and begins on a new page.[3] This section may also be called "Sources" or "Works Cited," depending on the nature of the referenced materials.

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[3] The "References" section is normally a required element of text. If an author does not refer to the work(s) of others, a "References" section becomes unnecessary.

To help readers use and assess referenced materials, all references include the following elements: name of author(s), title of referenced work, and publication data. If a government document is referenced, the National Technical Information Service (NTIS) number is included in the reference to facilitate user access to the government document.

References are prepared according to the accepted practice of the discipline in which the primary author of a report works. Two basic reference forms, each having its own advantage, are commonly used for reports. The number-identification system of citing material allows readers to locate references easily in a printed document. For this form, references are numbered consecutively with arabic numbers (in order of their first appearance in the text), keyed to appropriate places in the text, and fully identified in the successively numbered list of references.

In the second form of referencing, the author-date format, authors' names and dates of publication are cited in the text in parentheses and keyed to an alphabetically arranged list of references. The author-date style helps readers to associate facts and ideas with their originators and date of origin.[4]

If figures and tables are obtained from referenced material, the sources are identified in source or credit lines that are part of the figure(s) or table(s). A source or credit line contains adequate bibliographic data to enable readers to verify the location of the original figure(s) or table(s). Such sources are not further identified in the list of references unless an additional reference to them appears in the text of the report. (See also 5.2, Visual and Tabular Matter.)

4.3 Back Matter

The back matter supplements and clarifies the body of the report (for example, appendixes), makes the text easier to use (for example, glossary; lists of symbols, abbreviations, and acronyms; and index), and shows where additional information can be found (for example, bibliography).

4.3.1 Appendixes

Appendixes contain information that supplements, clarifies, or supports the text. These optional elements of back matter also contain material that might otherwise interfere with an orderly

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[4] *The Chicago Manual of Style* is a useful guide in matters of style and format for referenced materials.

presentation of ideas in the text because placing detailed explanations, supporting data, or long mathematical analyses in appendixes shortens the text and makes it easier to read. However, information essential to the purpose of the text appears in the text. For example, in a report about a new mathematical analysis, the detailed derivation of the equations belongs in the text, whereas other subjects, such as those that follow, appear in appendixes:

1. Detailed explanations and descriptions of test techniques and apparatus
2. Texts of other documents (for example, standard test procedures, laws, and management instructions)
3. Extensive data in the form of figures or tables
4. Computer listings of programs, input, and output
5. Mathematical analyses.

Other elements of back matter (for example, bibliographies) do not appear in appendixes.

Appendixes usually follow the references or last section of the text. Each appendix begins on a new, right-hand page and has a title that appears below the appendix designation, as in this example:

Appendix B
Complementary Energy Principle

Each appendix is referred to in the text. If the report contains more than one appendix, each is identified with a capital letter (Appendix A, Appendix B, and the like) in the order in which it is mentioned in the report. (A single appendix is labeled "Appendix.") Similar items may be combined to avoid creating unnecessary appendixes. For example, several sample forms can be combined rather than each being identified as a separate appendix.

Although figures and tables are best integrated into the text following their initial mention, figures, tables, or other graphics of secondary importance that provide back-up data are combined into an appendix. In appendixes, figures precede tables, with both groups arranged in numerical sequence. For ease of reading, figures and tables in appendixes are oriented vertically (portrait format). (See also 5.2, Visual and Tabular Matter.)

4.3.2 Bibliography

An optional bibliography lists additional sources of information that are not referenced in the text. If a bibliography is included in a report in addition to the list of references (part of the text), the

bibliography follows the appendix(es). A bibliography is unnecessary if the references that are used constitute a complete list of sources of information. Bibliographic entries are usually arranged alphabetically by author, but any logical order may be used if it is explained and is consistent. A bibliography section begins on a new page and is entitled "Bibliography."[5]

4.3.3 List(s) of Symbols, Abbreviations, and Acronyms

If the symbols, abbreviations, and acronyms in a report are numerous (more than five that are not readily recognized as standard in the field), or if there is a chance that readers will not understand them, a report requires a list of all symbols, abbreviations, and acronyms with an explanation of what each stands for. The optional list of symbols, abbreviations, and acronyms begins on a new page. (See also 5.9, Symbols, Abbreviations, and Acronyms.)

4.3.4 Glossary

A glossary is a list of terms defined and explained to facilitate a reader's comprehension of the report where numerous terms requiring definition are used. The optional glossary is part of the back matter. (Glossary terms are also defined at their first mention in the text.) Glossary terms are arranged in alphabetical order, each on a separate line followed by its definition. The glossary section, titled "Glossary," begins on a new page.

4.3.5 Index

An index is an alphabetical listing of all major topics discussed in a report. An index is optional in short reports (fewer than 50 pages), but reports of 50 pages or more usually contain an index to help readers locate information. An index entry cites the page or section where the topic can be found, thus affording readers quick reference on a particular topic. An index may identify and locate information, indicate its nature and scope, identify related entries, and clarify relationships between entries. The arrangement of an index and its level of detail are determined by the structure of the report, its target audience, and its anticipated uses.

The most common type of index for a report is the subject index in which subjects are presented alphabetically. Other types of indexes (for example, name index, number and code index) may also be used. They are placed before the subject index in the back matter.

In preparing an index, the number and kind of access points (entry locations) and the information level of indexable matter (for example, abstract or concrete) are determined. Each index entry has a heading (first element) and a locator (page or section number) where information about the entry will be found. Terms used as report headings are included in the index. The index contains all headings likely to be sought by the intended audience for a report. ANSI/NISO Z39.4-1995 establishes extensive guidelines for the preparation of indexes.

4.3.6 Distribution List

If included, the distribution list follows the index (or glossary, if no index appears in the back matter). The list indicates the complete mailing address of the individuals and organizations receiving copies of the report and the number of copies received. The Privacy Act of 1974 forbids federal agencies from listing the names and home addresses of individuals, so a distribution list contains business addresses only. Distribution lists provide a permanent record of initial distribution. In the case of classified reports, restricted-distribution reports, and reports containing proprietary data, such lists are extremely valuable because they can later be used for communicating instructions regarding handling and classification downgrading. A distribution list is also useful if errata are discovered and change pages are issued to correct a report. (See also 5.12, Errata.)

5. Design of Reports

This section establishes guidelines for ensuring consistency in presentation; designing visual and tabular matter; formatting and paginating a report; presenting units, numbers, formulas, and equations; incorporating footnotes, endnotes, references, and bibliographic entries; preparing lists of symbols, abbreviations, and acronyms, glossaries, and indexes; and correcting errata after printing.

5.1 Subordination

The subordination of ideas is indicated by the use of headings and subheadings that divide the report into manageable sections, call attention to main topics, and signal changes in topics. Primary headings identify major sections of the

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[5] *The Chicago Manual of Style* is a useful guide in matters of style and format for bibliographic entries.

report, and each major section equivalent begins on a new page in print. Reports that are shorter than 50 pages in length usually require no more than five levels of headings.

Consistency of presentation is important in showing subordinate relationships. Many reports use a decimal numbering system to show subordinate relationships and to simplify extensive cross-referencing. An alternate format for subordination uses typographic progression. (ANSI publications use a combination of the two formats for ease of cross-referencing.) Headings and subheadings are indicated by boldface type with initial capital letters for principal words. Primary headings are often indicated by a larger typeface than non-primary headings. Primary and secondary headings are aligned flush with the left column of text, and other headings are run in with indented text.

5.2 Visual and Tabular Matter

Much of the data in reports is presented in figures and tables. Figures provide visual representations in the form of graphs, line drawings, diagrams, photographs, and the like. Tables arrange large amounts of quantitative data in an ordered space. Following these guidelines will help ensure that figures and tables are effectively integrated with the text of a report:

1. Each figure or table is located near but never before its first mention in the text.
2. If a figure or table is central to the comprehension of the text, it is included in the text. If figures or tables provide only supplementary information, they appear in an appendix. Any material in an appendix is mentioned in the text; otherwise the information in the appendix lacks context.
3. The amount of text discussion required for each figure or table varies with its importance to the report, the level of complexity of the information illustrated or tabulated, and the level of knowledge of the anticipated readers.
4. Figures are numbered with consecutive arabic numbers (for example, Figure 1, Figure 2, . . .); those pertaining only to appendixes are numbered consecutively for each appendix (for example, Figure A1, Figure A2, . . . , Figure B1). Tables are also numbered consecutively (and independently of figures) with arabic numbers (for example, Table 1, Table 2, . . ., Table 8). If an appendix contains

its own tables in addition to text tables, the appendix tables are identified and numbered consecutively after the text tables (for example, Table 22, Appendix Table A1, . . .). If there is more than one appendix, table numbers begin again in each (for example, Table A1, Table A2, . . . Table B1, Table B2).

Portrait (vertical) rather than landscape (horizontal) orientation is the preferred format for figures and tables so that they can be viewed without turning a printed page sideways. Oversized figures or tables that fold in should be redesigned to fit a standard 8-1/2 x 11-inch page with portrait orientation, if possible. If the figure or table cannot be reduced to fit a standard page, redesigning it to fit two facing pages in a printed report is recommended.

5.2.1 Figures

Figures (for example, graphs and charts, diagrams, photographs, and schematic drawings) play a significant role in presenting and clarifying technical ideas. A figure emphasizes one main idea and shows no more than is necessary. Figures have informative titles (captions) and, as needed, callouts that identify each part of the figure clearly and concisely. The figure number and title appear below the figure. The placement and alignment of callouts is consistent. Callouts are placed horizontally and unboxed, and straight lines (leaders) connect callouts to the part(s) identified in a figure. Symbols, abbreviations, or acronyms that appear in figures (and tables) but not in the text are explained in a key or defined in a caption.

The type of figure used depends on the type of information to be presented. Graphs show relationships among data. Diagrams portray relationships among components. Photographs realistically depict general appearance. Drawings emphasize essential elements and omit unnecessary details.

The purpose of a figure, its reproducibility, and convenience of location for report readers are factors in figure preparation. Line art, original photographs, and digital image files are preferable for reproduction. Often, color is necessary for comprehension. If not, its use should be carefully considered because of limited reproducibility. Figure 6 shows an example of color substitutes; screens, crosshatching, patterned lines, or similar techniques are effective substitutes for color.

Figure 6: Use of graphic devices as color substitutes

□ WordFrame ■ WordPerfect
▦ MakerTeX ▫ IslandWrite
□ TeX ▨ All others

Aeronautics   Flight Systems   Space

Software Use by Directorate

Figure 7: Nomenclature for the parts of a table

Table 3. Table Number and Title.		
Stub Head	Column Head[a]	Column Head[b]
Row Head Data	Data	Data

Source Line:

[a] Footnote to table appears here.
[b] Footnote to table appears here.

Gauge graphic techniques to reproduction capabilities. The legibility of all symbols, letters, and lines becomes a key concern when paper copies of a report are reproduced. Letters and numbers on graphs and charts are positioned so that they can be read easily from the bottom and right-hand side of the graphical representation. When graphs represent trend curves, tick marks placed along the axes generally suffice for the required degree of approximation. If highly accurate readings are needed, grid lines may be used. Photographs are cropped and sized to show only significant details. To ensure legibility, the minimum acceptable line weight for drawings is 8 points. Graphic devices such as borders, frames, title blocks, and background tones are not used unless their use significantly improves the clarity of a figure.

5.2.2 Tables

Tables present detailed facts or statistics concisely in row-and-column format. A formal table has a table number and a title that are placed above the data. The title describes the content without giving background information, results, or comments about the table. The row head and column heads identify the tabulated data that appear in the body or cells of the table.

Footnotes to tables are identified independently of the text footnotes, using superscript lowercase letters, beginning with "a" in each table. If the use of lowercase letters leads to ambiguity, such as with chemical or mathematical formulas, a sequence of symbols (*, †, ‡, §, ‖, #, **, . . .) is used. Footnote letters are assigned in left-to-right, top-to-bottom order, and the footnotes are placed below the bottom line of the table. If a table or data in a table were obtained from a reference source, the table also has a source line that identifies the reference. (See also 4.2.7, References.) Figure 7 shows the parts of a table.

If necessary, tabular columns may be continued on successive pages. When a table is continued, the table number and title, row head, and column head are repeated and the continuation noted. If a table is carried over, at least two rows or columns are carried.

Units of measurement are given in the title, in the column heads, or in a note. If presented in the column heads, units and symbols appear in parentheses; they are not repeated in the columns. If data are unavailable for a particular cell, a dash is used to fill the vacancy.

Horizontal rules separate a table from the title and row heading, and column heads from the body of the table. Vertical rules may be used to separate columns if the use of vertical rules improves the ease of reading tabular material.[6]

5.3 Page Format

The physical appearance of a report, both text and graphics, constitutes format. The goal of any format is to enhance readability and comprehension by providing visual uniformity and a consistent subordination of ideas. Decisions about report formats are based on principles of graphic design, but format choices may be limited by contract specifications, in-house requirements, or the equipment used for publication.

5.3.1 Image Area

The space allotted on a page for printed material (text, visual, or tabular matter) is the image area. Observing a standard image area ensures that the

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[6] The U.S. Government Printing Office *Style Manual* and *The Chicago Manual of Style* provide detailed guidelines for creating tables.

information on a page will not be lost during printing and binding. The normal image area on 8-1/2 x 11-inch paper is 7-1/8 x 9-3/16 inches, or in printing terminology, 43 x 55 picas. The image area includes headers and footers, if they are used, and page numbers. For lead pages (standalone material, such as the foreword or table of contents), 1 inch is subtracted from the top of the image area.

5.3.2 Margins

Margins set off the area occupied by type. This area includes headers and footers. Although they are proportional, margins are not equal on all sides. By printing convention, the top margin is the narrowest, usually 1 inch. The outer margin is wider. The bottom margin is wider than both top and outer margins. To accommodate binding, the inner or gutter margin is the widest of the four. The default margins for most word processing software observe these printing conventions.

5.3.3 Line Length

Ragged right margins are preferred for ease of reading, but excessively ragged right margins can be avoided by using a standard and a minimum line length. The minimum line length is 2-3 picas shorter than the standard line length. A line ends with the word falling nearest the standard length of a line but does not exceed the standard length by more than two characters. For example, a single column of text intended for continuous reading (as opposed to reference material) may be set in standard lines 40-43 picas wide. To minimize ragged right margins, a recommended minimum line length is 38 picas. If a report is set in double-column format, the image area includes the space necessary to separate the columns, 1-2 picas. A recommended minimum line length for double columns is 20 picas per column with 2 additional picas between each column (a total of 42 picas).

5.3.4 Typography

Legibility, the speed with which each character is recognized, is a concern of type design. Readability refers to the arrangement of type for ease of reading. A type face (size and style) should be both legible and readable.

For report text, including mathematical notations, 10- or 12-point serif type is the most comfortable type face for readers. Smaller sizes can be used for non-text matter (for example, footnotes and indexes); however, 8 points is the smallest acceptable size for non-text matter.

The availability and appearance of specialized characters for symbols, formulas, and equations is an important consideration in selecting a type face.

5.3.5 Paper and Ink

Paper copies of scientific and technical reports use acid-free paper of (U.S.) standard size (8-1/2 x 11 inches). Color, smoothness, and weight are factors in selecting paper for printing a report. Type is most easily read against an off-white, uncoated stock; however, halftone illustrations (photographs) printed on coated paper are superior to those printed on uncoated stock. To ensure legibility and reproducibility, black ink is used for printing reports.

5.3.6 Printing Equipment

A laser or laser-quality printer with a minimum 300 dpi (dots per inch) resolution produces acceptable camera-ready copy for text and line work. If photographs or high resolution graphics are included electronically in a report, a printer with 600 dpi (or higher) resolution is preferred.

5.4 Pagination

Page numbers appear in the same place on each page (for example, bottom right) or in a consistent place on mirror-image pages (for example, upper, outer corners). Hyphens, parentheses, or other punctuation marks are not placed around page numbers.

Front matter is numbered with consecutive lowercase roman numerals. Page numbers are not shown on the cover and title page, although the title page is considered page i. A table of contents begins on a new odd-numbered right-hand page.

Consecutive arabic numbers are used for pages of the text (body), appendixes, and other back matter, beginning with the first right-hand page of the summary. Appendix information reproduced from another source retains the pagination of the original source in addition to being paginated for inclusion in the appendix.

If a report is divided into sections or chapters because of its length or scope, the text and back matter (exclusive of front matter) are numbered sequentially from one part to the next. The text of each volume of a multivolume report begins on a new page 1.

The optional use of headers and footers in the text is governed by the structure and nature of a

report. Headers and footers do not appear on lead pages, on the first page of the table of contents, or in the preface. Running headers are convenient for helping users locate information in long, complex reports.

When running headers appear on right-hand pages, the last text heading on the page is used as the running header. When running headers appear on left-hand pages, the first text heading to appear is used as the running header. If section titles are used as headings, they appear as running headers throughout the section. Running headers used for a section of notes in the back matter show inclusive page numbers where the relevant note references can be found (for example, Notes to Pages 23-31).

5.5 Units and Numbers

Standard units of measurement are presented clearly, concisely, and consistently in reports. The preferred standard for units is the International System of Units (SI). If another system is used, the corresponding SI units may appear in parentheses. If two systems of measurement are used, the system in which measurements were obtained is indicated in the "Methods, Assumptions, and Procedures" section and in a statement at the beginning of the list of symbols, abbreviations, and acronyms. (See also 4.2.3, Methods, Assumptions, and Procedures.)

Units used with specific numbers (for example, 3.7 m) are abbreviated except where a potential exists for misinterpretation; otherwise, units are spelled out. However, a symbol is spelled out the first time it is used in the text. For SI units derived from proper names, the symbols are shown in initial capital letters (for example, Hz, N); however, units that are spelled out (for example, hertz, newtons) are shown in lowercase letters. SI symbols are written in singular form; ANSI/IEEE 268-1982 (R1992) and ASTM E380-1991 provide detailed information on the use of SI symbols and units.

Arabic numbers are always used to express units of measurement and time in mathematical expressions, decimals, percentages, and proportions. For other expressions, the following apply:

1. If a sentence contains only one number and that number is greater than nine, it is indicated as a numeral; if a number is nine or less, it is spelled out.
2. A number at the beginning of a sentence is always spelled out.

3. Numerals are used for a group of two or more numbers, if one of them is 10 or greater (for example, a capacitor having 3 leads, 2 pairs of controls, and 12 settings).
4. The same guidelines apply to ordinal numbers, but ordinals and cardinals are treated separately if they appear together (for example, the 5th and 14th groups, containing six and seven items, respectively).
5. Arabic numbers are used for all numbering systems (page and section, table, figure, and reference numbers), except for roman-numeral pagination of front matter (for example, page iii).

5.6 Formulas and Equations

Formulas and equations are presented in sentence form and punctuated for clarity and consistency; however, a sentence does not begin with a formula or an equation.

Complicated mathematical formulas and derivations are clarified by defining symbols, relating equations to one another, and describing the physical reality represented by the mathematics. Chemical symbols need not be defined unless the author chooses to do so for clarification. Marginal notes are used to identify modifications of symbols (for example, prime marks) and to distinguish between the letter "O" and "0" (zero); the letter "l" and the number "1"; the letter "x" and the multiplication sign ($\times$). Superscripts and subscripts are also clearly indicated.

Brief formulas and equations are included as part of the text if the formula or equation fits on one line. If a formula or equation is displayed (set off from the text), it is centered or indented, depending on its length. In a report with extensive notation, all equations are displayed and numbered for consistent presentation. Formulas and equations are italicized whether included as part of the text or displayed.

Equation numbers are enclosed in parentheses at the right-hand margin with a minimum of 1/4 inch between the last term in the equation and the equation number. The equation number appears on the same line of a single-line equation and on the last line of a multiline equation.

If a long formula or equation does not fit on a single line, the order of preference for splitting it is:

1. Before an equality or inequality sign
2. Before a plus or minus sign
3. Before a multiplication sign
4. After a group of parentheses, brackets, or braces
5. Before an integral, summation, or product sign.

Extra line space is used between the lines when a formula or equation is carried over because of its length. A number of computer software packages that support the presentation of equations automatically provide correct line spacing. An example of a multiline equation, split to fit on a page, follows.

$$\int_0^a \int_0^b E(\eta,\xi)\, N_1(\eta,\xi)\, d\eta\, d\xi$$
$$= -\left\{ \int_0^a \int_0^b \left[\frac{\partial F}{\partial \eta}\frac{\partial N_1}{\partial \eta} + \frac{\partial F}{\partial \xi}\frac{\partial N_1}{\partial \xi} - \tilde{K}_x M\left(\frac{\partial F}{\partial \eta}\frac{\partial N_1}{\partial \eta}\right.\right.\right.$$
$$\left. + \frac{\partial F}{\partial \xi}\frac{\partial N_1}{\partial \xi}\right) - 3\tilde{K}_x\left(\frac{\partial M}{\partial \eta}\frac{\partial F}{\partial \eta}N_1\right) + \frac{\partial M}{\partial \xi}\frac{\partial F}{\partial \xi}\,N_1$$
$$+ K^2(3K_x - \tilde{K}_x^3)MFN_1 + K^2(\tilde{K}_x^2 - 1)FN_1$$
$$\left. - 3K^2\tilde{K}_x^2 MFN_1 + K^2\tilde{K}_x^3 M^3 FN_1\right]\, d\eta\, d\xi\Big\}$$

Chemical symbols may be defined if definition enhances their comprehension. Close spacing is used for chemical symbols, numbers, or line bonds in a formula. In the text, chemical equations may be run in or displayed. Chemical symbols are set in roman (English) type rather than italics. If displayed, they should be numbered in sequence, and the equation numbers placed to the left of the reaction. Chemical equations are not numbered consecutively independent of mathematical equations.

If a chemical equation is too long to fit on one line, it is broken after the arrow. The first element of the runover line is aligned with the last element of the preceding line. Extra line space is left between the lowest part of the first line and the highest part of the next line.[7] An example of a chemical equation broken after the arrow follows.

$$Co(NH_3)_6^{3+} + 6H_3O^+ \rightleftharpoons$$
$$Co(H_2O)_6^{3+} + 6NH_4^+ \qquad K_c \simeq 10^{20}$$
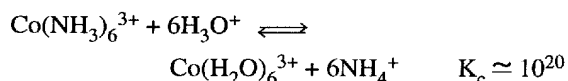
5.7 Footnotes or Endnotes
Footnotes or endnotes are included in a report only to clarify information in the text and are as brief as possible. To avoid preparing footnotes or endnotes, an author may incorporate material into the text by enclosing it in parentheses or by placing it in a separate paragraph.

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[7] *Mathematics into Type, The Chicago Manual of Style,* and the *CRC Handbook of Chemistry and Physics* present detailed information about the preparation and physical arrangement of mathematical and chemical formulas and equations.

When used to clarify information, notes are keyed to the text of the report with superscript arabic numbers. Notes are numbered consecutively through the text; footnotes appear at the bottom of the page on which each occurs, and endnotes appear at the end of the section of text they clarify. If a footnote runs longer than its page margin, the footnote is completed at the bottom of the subsequent page, preceding any footnote(s) for the next page. If a footnote is used to clarify tabular information, a superscript sequence of lowercase letters or symbols is used to avoid confusion with text footnotes. (See also 5.2.2, Tabular Matter.)

5.8 References and Bibliographic Entries
The first line of a reference is indented, and subsequent lines are aligned flush with the left margin. Entries in a bibliography are aligned flush left (without paragraph indentation). If a bibliographic entry runs longer than a single line, subsequent (runover) lines are uniformly indented.

5.9 Symbols, Abbreviations, and Acronyms
Symbols, abbreviations, and acronyms are spelled out at their first mention in the text to ensure that readers will understand them; however, standard mathematical notation, chemical symbols, and known abbreviations of measurement are not defined unless potential exists for misinterpretation. An acronym is written out the first time it is used in the text, and it is also included in a list of symbols, abbreviations, and acronyms. Symbols that are standard in the discipline of a report are used. Appendix A, "Selected Annotated Bibliography," includes standards for symbols used in many disciplines. If no standard has been established for a concept, consult related scientific or technical literature for a symbol in general use. When they occur in lists, symbols, abbreviations, and acronyms are presented in descending order, as follows:

1. Roman (English) alphabet capital letters
2. Roman (English) alphabet lowercase letters
3. Greek alphabet capital letters
4. Greek alphabet lowercase letters
5. Subscripts
6. Superscripts
7. Special notes.

If a symbol, abbreviation, or acronym has more than one definition, the explanations are

separated by a semicolon, and each definition is explained at its first use in the report.

Symbols, abbreviations, and acronyms and their definitions are displayed in two columns with the abbreviations and acronyms listed in alphabetical order and aligned with the left margin. Each entry begins on a new line, followed in the second column by its definition. Adequate space is left between the longest symbol, abbreviation, or acronym and its definition, and the rest of the entries in the list(s) are aligned accordingly.

5.10 Glossary Entries

Glossary entries are arranged in alphabetical order and aligned with the left margin. Subsequent lines are uniformly indented. Each definition begins with a capital letter and ends with a period.

5.11 Index Entries

Index entries customarily appear single spaced in two-column or three-column format on a page. Main entries are capitalized only for proper names; subentries are always lowercased (unless they begin with a proper name) and are uniformly indented 1 em for each level of modification. Runover lines are indented 1 em deeper than the deepest subentry.

5.12 Errata

If errors severe enough to cause misunderstanding are discovered too late for correction prior to the distribution of a report, an errata sheet that identifies the report and the error(s) is sent to initial and subsequent recipients of the report. The sheet is inserted immediately following the cover. An error in the text is identified by line, and an error in a formula or an equation is identified by number and the correction noted. The following form is used for corrections:

Page	Reads	Should Read
37, line 5	cosine of the angle	sine of the angle

ANSI/NISO Z39.18-1995

Appendix A
Selected Annotated Bibliography

(This appendix is not part of American National Standard for Scientific and Technical Reports — Elements, Organization, and Design, ANSI/NISO Z39.18-1995. It is included for information only.)

A1. General

This annotated bibliography is intended to help authors and editors organize, design, and publish reports. The bibliography is extensive, but not exhaustive. The absence of a particular publication is no reflection of its quality or usefulness. The list is simply a starting point from which the user can begin to build a professional reference collection or consult a particular source to answer a question. The use of a particular source will depend on such factors as personal preference, subject matter, and the specific needs of the user.

The bibliography is divided into seven categories:

1. writing, usage, style, grammar, and English language dictionaries;
2. style manuals and guides;
3. specialized dictionaries, encyclopedias, and handbooks;
4. technical writing materials;
5. standards and symbols;
6. library reference materials; and
7. graphic arts.

Reasonable attempts were made to identify and include the classical or standard sources for each category, or both. Several sources and numerous individuals were consulted in compiling the bibliography. Each citation was verified for correctness, most recent edition, and availability. To the best of our knowledge, no out-of-print sources were included.

A2. Writing, Usage, Style, Grammar, and English Language Dictionaries

Barzun, Jacques. *Simple and Direct: A Rhetoric for Writers*. Rev. ed. New York: Harper and Row, 1985.
A thorough discussion of faults in prose and their remedies. Proceeds from word choice through sequence and linkage, tone, meaning, structure, and revision.

Bernstein, Theodore M. *The Careful Writer: A Modern Guide to English Usage*. New York: Atheneum, 1965.
An alphabetically arranged list of usages, good and bad, with a discussion of why they should be embraced, tolerated, or shunned. A guide for manuscript editors.

Bernstein, Theodore M. *Miss Thistlebottom's Hobgoblins: The Careful Writer's Guide to the Taboos, Bugbears, and Outmoded Rules of English Usage.* New York: Simon and Schuster, 1984. Reprint of 1971 ed.
A discussion of invalid and outmoded rules commonly applied to prose and usage. A guide for both writers and editors.

DeVries, Mary A. *The New American Dictionary of Abbreviations.* New York: Penguin Books, 1991.
Provides extensive coverage of standard abbreviations and their definitions.

Ebbitt, Wilma R. and Ebbitt, David R. *Writer's Guide and Index to English.* 8th ed., Glenview, IL: Scott, Foresman, 1990.
A comprehensive reference book that includes articles on grammar, parts of speech, sentence structure, diction, punctuation, mechanics, logic, rhetoric, and style. Arranged alphabetically.

Follett, Wilson. *Modern American Usage: A Guide.* Edited and completed by Jacques Barzun and others. New York: Avenel Books, 1980.
A dictionary of usage containing essays on a number of questions of concern to authors and editors.

Fowler, H. W. *A Dictionary of Modern English Usage.* 2nd ed. Revised by Sir Ernest Gowers. New York: Greenwich House, 1983.
A classic work on English usage offering guidance to both writers and editors.

Gilman, E. Ward (ed.). *The Merriam-Webster Dictionary of English Usage.* Springfield, MA: Merriam-Webster, Inc., 1989.
Provides guidance on usage as well as the history of the usage and criticism of it, analysis and examples of contemporary usage, and conclusions and recommendations about usage.

Hodges, John C.; Whitten, Mary E.; with Webb, Suzanne S. *Harbrace College Handbook..* 11th ed. New York: Harcourt Brace Jovanovich, 1990.
A standard college grammar book. A comprehensive, yet concise, summary of grammar and usage.

Mager, Nathan H. and Mager, Sylvia K. *Encyclopedic Dictionary of English Usage.* Englewood Cliffs, NJ: Prentice-Hall, 1974.

A combination dictionary, grammar guide, and style manual. Contains over 15,000 entries listed alphabetically and gives accepted rules, styles, and usage.

McArthur, Tom (ed.). *The Oxford Companion to the English Language*. New York, NY: Oxford University Press, 1992.
Short articles cover virtually every aspect of language such as grammar, literary terms, linguistics, rhetoric, style, sexist language, child language acquisition, and the history of the language. Covers the period from the Roman era to the 1990s.

Morris, William and Morris, Mary. *Harper Dictionary of Contemporary Usage*. 2nd ed. New York: Harper and Row, 1985.
A dictionary concerning writing and speaking styles and usage, grammar, punctuation, and idioms. A guide for both writers and editors.

Roget's International Thesaurus. 5th ed. Revised by Robert L. Chapman. New York: Harper and Row, 1992.
A classic dictionary of synonyms that covers all relationships among words. A guide for authors and editors.

Soukhanov, Anne E. (ed.). *The American Heritage Dictionary of the English Language*. 3rd ed. Boston: Houghton Mifflin, 1992.
A standard American dictionary that provides a thorough discussion of usage.

Strunk, William, Jr. and White, E. B. *The Elements of Style*. 3rd ed. New York: Macmillan, 1979.
A short classic offering practical advice on achieving a clear writing style. A good resource for both authors and editors.

Trimmer, Joseph F. and McCrimmon, James K. *Writing with a Purpose*. 9th ed. Boston: Houghton Mifflin, 1987.
A standard college writing book. Covers various elements of the writing process including planning, revising, paragraph development, sentence patterns, diction, and tone and style.

U.S. Treasury Department, Internal Revenue Service. *Effective Revenue Writing 1*. Training 9960-12 (8-69). GPO S/N 048-004-00036-0. Washington, DC: U.S. Government Printing Office, 1969. (Reprinted 1980.)
A publication used as a text for a basic writing course for IRS employees in writing improvement. Covers principles of writing, grammar, punctuation, and parts of speech.

U.S. Treasury Department, Internal Revenue Service. *Effective Revenue Writing 2*. By Calvin Linton. Training 9931-15 (rev 1978). GPO S/N

048-004-00037-7. Washington DC: U.S. Government Printing Office, 1978.
A publication used as a text for an advanced training course designed to help experienced IRS writers and reviewers diagnose and cure writing weaknesses. Includes numerous examples of analyzing and revising poorly written sentences.

Webster's Tenth New Collegiate Dictionary. Springfield, MA: Merriam-Webster, 1993.
Prepared after the parent work, the collegiate represents the later thinking of the editors on the principles of word division and frequently departs from the divisions given in the unabridged version.

Webster's Third New International Dictionary of the English Language. Unabridged. Springfield, MA: Merriam-Webster, 1981.
A standard dictionary for the spelling of English words and a basic reference for any editorial office or library.

A3. Style Manuals and Guides

American Mathematical Society. *Manual for Authors of Mathematical Papers*. Reprinted from the Bulletin of the American Mathematical Society, vol. 68, no. 5 (September 1962).
Advises mathematicians preparing papers for publication on how to improve the readability and appearance of mathematical material.

American Psychological Association. *Publication Manual for the American Psychological Association*. 4th ed. Washington, DC: APA, 1994.
A manual of editorial style for manuscripts submitted to journals published by the American Psychological Association (APA) and other journals that use APA style. Includes publication procedures and policies for APA journals, citation and reference forms, and brief comments on theses, dissertations, and oral presentations of papers.

Bishop, Elan E.; Eckel, Edwin B.; and others. *Suggestions to Authors of the Reports of the United States Geological Survey*. 6th ed. GPO S/N 024-001-03010-1. Washington, DC: U.S. Government Printing Office, 1978.
A guide providing detailed information on specific geological expressions and references to works in the field. Contains a short grammar section.

Campbell, William G.; Ballou, Stephen V.; and Slade, Carole. *Form and Style: Theses, Reports, Term Papers*. 8th ed. Boston: Houghton Mifflin, 1990.
Covers such topics as the elements of a thesis,

style and usage, and typing the paper. Provides guidance on quotations, bibliographic format, and references.

Cathcart, M. E. *STI Handbook: Guidelines for Producing, Using, and Managing Scientific and Technical Information in the Department of the Navy (A Handbook for Navy Scientists and Engineers on the Use of Scientific and Technical Information).* San Diego, CA: Office of Naval Technology, 1992.
Provides specific guidelines for U.S. Navy authors on preparing reports. Prepared for the Office of Naval Technology by the Naval Command, Control and Ocean Surveillance Center, RDT&E Division, San Diego, CA.

Council of Biology Editors. *Scientific Style and Format.* Edited by Edward J. Huth. 6th ed. Bethesda, MD: Council of Biology Editors, 1994.
A style manual including sections on grammar, writing style, and indexing. Especially useful for authors of works in special fields of biology. Provides guidance on the treatment of mathematical and statistical information and abbreviations.

Columbia Law Review Association, and others. *The Bluebook: A Uniform System of Citation.* 15th ed. Cambridge, MA: The Harvard Law Review Association, 1991.
Provides guidance for legal writing. Gives citation form for cases, statutes, government documents, books, and other printed materials.

Fleischer, Eugene B. *A Style Manual for Citing Microform and Nonprint Media.* Chicago: American Library Association, 1978.
Rules for citing sound recordings, maps, video recordings, motion pictures, microforms, and other media.

Howell, John Bruce. *Style Manuals of the English-Speaking World: A Guide.* Phoenix, AZ: Oryx Press, 1983.
Describes 231 style manuals and guides of over 5 pages in length. Divides them into general, subject (20 disciplines), manuals and styles related to disabled people, and guidelines on avoiding sexist language.

Li, Xia; and Crane, Nancy B. *Electronic Style: A Guide to Citing Electronic Information.* Westport, CT: Meckler Publishing, 1993.
Presents basic forms for the kinds of information being cited and recommends the types of elements to be included and the order of their presentation. Covers citations of full-text and bibliographic databases, electronic conferences

and bulletin board services, electronic mail, and computer programs. Generally follows APA style with some modifications.

Rubens, Philip. *Science and Technical Writing: A Manual of Style.* New York, NY: Henry Holt, 1992.
A comprehensive style guide that covers science, technical, medical, corporate, and business writing; graphic and electronic design; and training and education.

Skillin, Marjorie E.; Gay, Robert M.; and others. *Words into Type.* 3rd ed. Englewood Cliffs, NJ: Prentice-Hall, 1974.
A comprehensive manual covering the entire publishing process from writing through printing and binding. Includes particularly useful sections on grammar, word usage, and style. Extensive coverage of typography.

Swanson, Ellen. *Mathematics into Type: Copyediting and Proofreading of Mathematics for Editorial Assistants and Authors.* Rev. ed. Providence, RI: American Mathematical Society, 1979.
Includes instructions on all phases of producing a book or an article in the field of mathematics. Covers such elements as the preparation and submission of a manuscript, editing and marking, design and typesetting, proofreading, and page makeup.

Turabian, Kate L. *A Manual for Writers of Term Papers, Theses, and Dissertations.* 5th ed. Chicago: University of Chicago Press, 1990.
A publication based on *The Chicago Manual of Style.* Turabian's shorter manual treats the preparation of typed or word-processed copy. Includes guidance on footnotes, references, and quotations.

U.S. Government Printing Office. *Style Manual.* Rev. ed. GPO S/N 2100-0068. Washington, DC: U.S. Government Printing Office, 1984.
A general style guide for preparing government publications. Contains details not found elsewhere regarding treatment of foreign currency, political divisions, plant and insect names, and other specialized expressions.

University of Chicago Press. *The Chicago Manual of Style.* 14th ed. Chicago: University of Chicago Press, 1993.
A widely used and referenced style manual. Includes detailed sections on mathematical copy, treatment of foreign languages, preparation of indexes, and distinctive treatment of words.

A4. Specialized Dictionaries, Encyclopedias, and Handbooks

American Society for Testing and Materials. *Annual Book of ASTM Standards*. Philadelphia, PA: American Society for Testing and Materials, 1994.

The official standard of the ASTM. A reference for the definitions used in the field of testing and materials.

Bartlett, John. *Familiar Quotations: A Collection of Passages, Phrases, and Proverbs Traced to Their Sources in Ancient and Modern Literature*. Edited by Emily Morrison Beck. 16th ed. revised and enlarged. Boston: Little, Brown, 1992.

The traditional source to consult in checking a familiar quotation.

Beyer, William H. (ed.). *Standard Mathematical Tables and Formulae*. 29th ed. Boca Raton, FL: CRC Press, 1991.

A classical mathematical reference. Writers and editors in need of more extensive or additional tables and mathematical reference material should refer to *Handbook of Mathematical Sciences* (6th ed., 1987) and *Handbook of Tables for Probability and Statistics* (2nd ed., 1968) by the same editor and publisher.

The Condensed Chemical Dictionary. 10th ed. Revised by Gessner G. Hawley. New York: Van Nostrand Reinhold, 1983.

A detailed reference work on the chemical industry. Contains technical descriptions of chemicals, raw materials, and processes; definitions of chemical compounds, phenomena, and terminology; and identification of trademarked products and their manufacturers.

Considine, Douglas M., ed. *Van Nostrand's Scientific Encyclopedia*. 7th ed. New York: Van Nostrand Reinhold, 1988.

An alphabetical arrangement of terms used in science and technology. A useful work for both the scientist and the layperson. Contains approximately 16,500 entries.

Dorland's Illustrated Medical Dictionary. 27th ed. Philadelphia, PA: W. B. Saunders, 1988.

A traditional source for checking spelling and meaning of medical and related terms.

Edmunds, Robert A. *The Prentice-Hall Encyclopedia of Information Technology*. Englewood Cliffs, NJ: Prentice-Hall, 1987.

Introduction to information terminology. Provides definitions for numerous computer terms and phrases, many of which are taken from the *American National Dictionary for Information Processing, X3/TR-1-82*.

Hampel, Clifford A.; and Hawley, Gessner G. *Glossary of Chemical Terms*. 2nd ed. New York: Van Nostrand Reinhold, 1982.

Provides extensive coverage of chemical terminology.

Institute of Electrical and Electronics Engineers. *American National Standard Dictionary of Electrical and Electronic Terms*. 3rd ed. ANSI/IEEE 100. New York: ANSI, 1984.

An official ANSI/IEEE dictionary defining technical words and terms from every area of electrical engineering, electronics, and computer sciences.

James, Robert C. *The Mathematics Dictionary*. 5th ed. New York: Van Nostrand Reinhold, 1992.

Defines mathematical terms and phrases; includes tables, formulas, mathematical symbols, and vocabularies giving English equivalents of mathematical terms in French, German, Russian, and Spanish.

Kirk-Othmer Encyclopedia of Chemical Technology. 4th ed. New York: John Wiley and Sons, 1991 (Vol. 1) and 1992 (Vols. 2, 3, and 4).

Contains comprehensive review of major individual chemicals, classes of chemicals, and chemical processes and technologies.

Parker, Sybil P.; et al. (eds.) *McGraw-Hill Dictionary of Scientific and Technical Terms*. 4th ed. New York: McGraw-Hill, 1989.

A dictionary defining over 100,000 terms from the sciences and engineering fields. Entries do not include syllabification, pronunciation, or etymological information. Includes several useful appendixes.

Parker, Sybil P.; et al. (eds.) *McGraw-Hill Encyclopedias of Chemistry* (2nd ed.), *Engineering* (2nd ed.), *Environmental Science and Engineering* (3rd ed.), *Physics* (2nd ed.), and *Science and Technology* (7th ed). New York: McGraw-Hill, 1993.

Standard reference for chemistry, engineering, environmental science and engineering, physics, and science and technology. Articles are arranged alphabetically and supplemented by drawings, graphs, charts, and photographs.

Pedde, Lawrence D., and others. *Metric Manual*. U.S. Bureau of Reclamation. GPO S/N 024-003-00129-5. Washington, DC: U.S. Government Printing Office, 1978.

Presents the basics of SI (International System of Units), metric conversion techniques, and examples of engineering problems associated with metric conversion.

Rosenberg, Jerry M. *McGraw-Hill Dictionary of Information Technology and Computer Acronyms, Initials, and Abbreviations.* New York: McGraw-Hill, 1992.

Provides definitions and explanations of terminology related to information technology and well-known computing applications.

Weast, Robert C.; et al. (eds). *CRC Handbook of Chemistry and Physics: A Ready-Reference Book of Chemical and Physical Data.* 71st ed. Boca Raton, FL: CRC Press, 1994.

A classic handbook of chemistry and physics. Includes mathematical and chemical tables and tables of physical constants and organic and inorganic compounds.

A5. Technical Writing Material

Anderson, Paul V. *Technical Writing: A Reader-Centered Approach.* 2nd ed. San Diego: Harcourt Brace Jovanovich, 1991.

This student text covers the writing process in seven sections: defining objectives, planning a report, drafting it, evaluating and revising it, superstructures (formats), and special activities such as oral presentations. Includes a handbook.

Brusaw, Charles T.; Alred, Gerald J.; and Oliu, Walter E. *Handbook of Technical Writing.* 4th ed. New York: St. Martin's Press, 1993.

This alphabetically arranged handbook covers usage, parts of speech, types of technical writing, format and graphics, writing and rhetorical principles, and mechanics.

Chandler, Harry E. *Technical Writer's Handbook.* Metals Park, OH: American Society for Metals, 1983.

A handy reference for preparing technical materials. This book is divided into three parts: writing; customs, practices, and standards for technical writing; and an anthology of stylebooks.

Clements, Wallace and Berlo, Robert. *The Scientific Report: A Guide for Authors.* Washington, DC: Society for Technical Communication, 1984.

Divided into two parts: advice for the writer and aids for the writer. Includes such topics as effective writing, the components of a report, graphics (including tables), footnotes and references, abbreviations, spelling, rules for writing numbers, and rules for presenting mathematical expressions.

Day, Robert A. *How to Write and Publish a Scientific Paper.* 4th ed. Phoenix, AZ: Oryx Press, 1994.

A book on writing and publishing primary research papers in scholarly journals. Anec-

dotal discussion provides a biological sciences editor's view of articles written by professionals already in the field.

Houp, Kenneth W. and Pearsall, Thomas E. *Reporting Technical Information.* 7th ed. New York: Macmillan, 1993.

Six discrete sections: Part I covers the basics; Part II treats techniques; Part III covers document design; Part IV applies principles to numerous correspondence and report products; Part V covers oral reports; and Part VI is a handbook of errors and punctuation rules in technical writing.

Lannon, John M. *Technical Writing.* 3rd ed. Boston: Little, Brown, 1985.

An introductory text with procedural approach for preprofessional majors in all fields, especially in the biological and health sciences. Strong composition orientation with accent on academic writing and language topics.

Mathes, John C. and Stevenson, Dwight W. *Designing Technical Reports: Writing for Audiences in Organizations.* New York: Macmillan, 1991.

An advanced text with a rhetorical approach to professional report writing for technical personnel, particularly engineers. Teaches a systematic procedure for designing reports based on functional ends for multiple, diverse readers. Method is applicable to all formats from short memos through formal reports, to most reporting situations, and to all conventional report types.

Michaelson, Herbert B. *How to Write and Publish Engineering Papers and Reports.* 3rd ed. Phoenix, AZ: Oryx Press, 1990.

Details the process of engineering writing and the preparation of formal papers and reports for publication.

Sherman, Theodore A. and Johnson, Simon S. *Modern Technical Writing.* 5th ed. Englewood Cliffs, NJ: Prentice-Hall, 1990.

Organizes extensive coverage of technical writing under four topics: concepts (for example, technical style, graphics, basic techniques of description and process); applications (types, procedures, proposals); correspondence (form, types, job letters); and handbook matters.

Tichy, H. J. *Effective Writing for Engineers, Managers, and Scientists.* 2nd ed. New York: John Wiley and Sons, 1988.

Emphasizes the writing process in five sections: steps to better writing, standards of correctness, style, advice on common forms, and the role of an editor.

Weisman, Herman M. *Basic Technical Writing*. 6th ed. Columbus, OH: Charles E. Merrill Publishing Company, 1992.
Covers basic expository techniques, correspondence, and report writing. Separate chapters cover organizing data, report format elements, mechanics and documentation, and graphics.

Weiss, Edmond H. *The Writing System for Engineers and Scientists*. Englewood Cliffs, NJ: Prentice-Hall, 1982.
Describes a system for writing about technical information. The system is composed of five parts: the system overview, planning, design guidelines, the draft, and editing and reproduction.

Wilkinson, Antoinette M. *The Scientist's Handbook for Writing Papers and Dissertations*. Englewood Cliffs, NJ: Prentice-Hall, 1991.
Begins by reviewing scientific research methods and then traces the way a scientific article evolves (introduction, methods, results, discussion). Also covers many types of visuals and how to publish an article.

A6. Standards and Symbols

A6.1 Standards

American Society for Testing and Materials. *Standard Practice for Use of the International System of Units (SI) (The Modernized Metric System)*. ASTM E380 REV A-91. Philadelphia: ASTM, 1991.

Association for Information and Image Management. *American National Standard—Microfiche*. ANSI/AIIM MS5-91.

Institute of Electrical and Electronics Engineers. *American National Standard for Metric Practice*. ANSI/IEEE 268-92.

Kleinman, Joseph M. *List of Specifications and Standards Pertaining to Technical Publications*. Washington DC: Society for Technical Communication, 1983.
Includes a compilation of military specifications and standards, including federal supply classifications, international standard documents, and industry standards that pertain to technical reports. The numerical listing gives titles and dates of latest issue.

National Information Standards Organization. *Indexes and Related Information Retrieval Devices*. ANSI/NISO Z39.4-199X (draft standard).

National Information Standards Organization. *Standard Technical Report Number (STRN) Format and Creation*. ANSI/NISO Z39.23-1990.

National Information Standards Organization. *Writing Abstracts*. ANSI/NISO Z39.14-1979 (R1986).

Procedures for the Transfer of Federal Scientific, Technical, and Engineering Information to NTIS under Public Law 102-245, Section 108. Federal Register 59 (1), January 3, 1994.
Outlines procedures for federal agencies to transfer to NTIS unclassified scientific, technical, and engineering information resulting from federally funded research and development activities.

A6.2 Graphic Symbols

American Society of Mechanical Engineers. *American National Standard Graphic Symbols for Fluid Power Diagrams*. ANSI Y32.10-1967 (R1987). New York: ANSI, 1987.

American Society of Mechanical Engineers. *American National Standard Graphic Symbols for Plumbing Fixtures for Diagrams Used in Architecture and Building Construction*. ANSI Y32.4-1977 (R1987). New York: ANSI, 1987.

American Society of Mechanical Engineers. *American National Standard Graphic Symbols for Railroad Maps and Profiles*. ANSI Y32.7-1972 (R1987). New York: ANSI, 1987.

American Society of Mechanical Engineers. *American National Standard Graphical Symbols for Process Flow Diagrams in the Petroleum and Chemical Industries*. ANSI Y32.11-1961 (R1985). New York: ANSI, 1985.

American Society of Mechanical Engineers. *American National Standard Symbols for Mechanical and Acoustical Elements as Used in Schematic Diagrams*. ANSI Y32.18-1972 (R1985). New York: ANSI, 1985.

American Welding Society. *American National Standard Symbols for Welding, Brazing, and Nondestructive Examination*. ANSI/AWS A2.4-1986. New York: ANSI, 1986.

Institute of Electrical and Electronics Engineers. *American National Standard Graphic Symbols for Electrical Wiring and Layout Diagrams Used in Architecture and Building Construction*. ANSI Y32.9-1982 (R1989). New York: ANSI, 1989.

Institute of Electrical and Electronics Engineers. *American National Standard Graphic Symbols for Electrical and Electronics Diagrams (Including Reference Designation Class Designation Letters)*. ANSI/IEEE 315-1975 (R1989). New York: ANSI, 1989.

Institute of Electrical and Electronics Engineers. *Supplement to ANSI Graphic Symbols for Electrical and Electronics Diagrams*. ANSI/IEEE 315-

1986. New York: ANSI, 1986.

Institute of Electrical and Electronics Engineers. *American National Standard Graphic Symbols for Grid and Mapping Diagrams Used in Cable Television Systems.* ANSI/IEEE 623-1976 (R1988). New York: ANSI, 1988.

Institute of Electrical and Electronics Engineers. *American National Standard Graphic Symbols for Logic Functions.* ANSI/IEEE 91. New York: ANSI, 1984.

Institute of Electrical and Electronics Engineers. *Supplement to IEEE Standard for Graphic Symbols for Logic Functions.* ANSI/IEEE 91A-1991. New York: ANSI, 1991.

Institute of Electrical and Electronics Engineers. *American National Standard Reference Designations for Electrical and Electronics Parts and Equipment.* ANSI/IEE Y32.16-1975 (R1988). New York: ANSI, 1988.

Instrument Society of America. *American National Standard Instrumentation Symbols and Identification.* ANSI/ISA S5.1-1984 (R1992). New York: ANSI, 1992.

National Fire Protection Association. *American National Standard for Symbols for Fire Safety.* ANSI/NFPA 170-1991. New York: ANSI, 1991.

A6.3 Letter Symbols

American Society of Mechanical Engineers. *American National Standard Glossary of Terms Concerning Letter Symbols.* ANSI Y10.1-1972 (R1988). New York: ANSI, 1988.

American Society of Mechanical Engineers. *American National Standard for Selecting Greek Letters Used as Letter Symbols for Engineering Mathematics.* ANSI Y10.17-1961 (R1988). New York: ANSI, 1988.

American Society of Mechanical Engineers. *American National Standard Letter Symbols and Abbreviations for Quantities Used in Acoustics.* ANSI/ASME Y10.11-1984. New York: ANSI, 1984.

American Society of Mechanical Engineers. *American National Standard Letter Symbols for Chemical Engineering.* ANSI Y10.12-1955 (R1988). New York: ANSI, 1988.

American Society of Mechanical Engineers. *American National Standard Letter Symbols for Heat and Thermodynamics.* ANSI Y10.4-1982 (R1988). New York: ANSI, 1988.

American Society of Mechanical Engineers. *American National Standard Letter Symbols for Illuminating Illustrations.* ANSI Y10.18-1967 (R1987). New York: ANSI, 1987.

American Society of Mechanical Engineers. *American National Standard Letter Symbols for Mechanics and Time-Related Phenomena.* ANSI/ASME Y10.3M-1984. New York: ANSI, 1984.

Institute of Electrical and Electronics Engineers. *American National Standard Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.* ANSI/IEEE 280-1985 (R1991). New York: ANSI, 1991.

Institute of Electrical and Electronics Engineers. *American National Standard Letter Symbols for Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).* ANSI/IEEE 260-1978 (R1991). New York: ANSI, 1991.

A7. Library Reference Material

American Chemical Society Chemical Abstracts Service. *Chemical Abstracts Service Source Index, 1907-1989 Cumulative.* Columbus, OH: Chemical Abstracts Service. Updated quarterly.

Lists the standard (preferred) abbreviations for titles of journals in the biological and physical sciences. Gives former title, if any; language of publication; publication history; publisher's address, price, and the like.

Books in Print. New York: R. R. Bowker. Published annually.

The standard annual listing of books issued by American publishers in author-title-series formats. Useful for checking bibliographies and notes. An editorial office should have access to the current edition, plus at least a selection of earlier volumes.

Borko, Harold, and Bernier, Charles L. *Indexing Concepts and Methods.* New York: Academic Press, 1978.

A thorough treatment of indexing principles and practices. Combines comprehensive coverage of established methods with explorations of the use of computers.

Cremmins, Edward T. *The Art of Abstracting.* Philadelphia: ISI Press, 1982.

Focuses on procedure for writing and editing abstracts. Also intended as a textbook on abstracting. Includes a glossary and annotated bibliographies on abstracting and thinking and cognition.

Gorman, Michael, and Winkler, Paul W. (eds.) *Anglo-American Cataloging Rules.* 2nd ed., 1988 revision. Chicago: American Library Association, 1988.

Intended for library catalogers, but is useful for editors, especially for the forms and alphabetization of proper names.

Guidelines for Descriptive Cataloguing of Reports: A Revision of the COSATI Standard for Descriptive Cataloging of Government Scientific and Technical Reports. Washington, DC: CENDI Cataloging Committee (Commerce, Energy, NASA, Defense Information), 1985. Available from NTIS, Springfield, VA 22161 as PB86-112349.

This is an update of the COSATI guidelines for descriptive cataloging of scientific and technical reports. The COSATI guidelines have been followed by the major federal information processing agencies since the early 1960s.

Cataloging Government Documents: A Manual of Interpretation for AACR2. Chicago: American Library Association, 1984.

Addresses the rules in AACR2 regarding their application to government documents. Provides guidelines for aspects of government document cataloging not covered by AACR2.

Information Please Almanac Atlas and Yearbook. Boston: Houghton Mifflin, 1994. Published annually.

Convenient source of information on many topics.

Patry, William F. *The Copyright Law.* 6th ed. Washington, DC: Bureau of National Affairs, 1986.

A standard work on copyright law.

Strong, William S. *The Copyright Book: A Practical Guide.* 4th ed. Cambridge, MA: M.I.T. Press, 1993.

A succinct and well-written analysis of the law and a practical guide to its application.

Corporate Author Authority List. Springfield, VA: National Technical Information Service. Available from NTIS as PB83-156034. Issued annually.

Lists corporate authors for use in cataloging and identifying organizations. Current and former names of organizations are included.

The United States Government Manual. GPO S/N 022-003-01109-9. Washington DC: U.S. Government Printing Office. Published annually.

Focuses on the programs and activities of the agencies of the legislative, judicial, and executive branches. Identifies officials, quasi-official agencies, boards, committees, and commissions.

Weil, Ben H., and Polansky, Barbara Friedman (eds.) *Modern Copyright Fundamentals.* Rev.

2nd printing. Medford, NJ: Learned Information for the American Society for Information Science, 1989.

An analysis of copyright law and its practical application.

A8. Graphic Arts

Association of American Publishers. Electronic Manuscript Series. *Standard for Electronic Manuscript Preparation and Markup.* Washington, DC: Association of American Publishers, 1986.

An SGML application conforming to International Standard ISO 8879: Standard Generalized Markup Language for preparation of electronically processed documents.

Baird, Russell B., and others. *The Graphics of Communication: Methods, Media, and Technology.* 6th ed. Fort Worth, TX: Harcourt Brace Jovanovich, 1993.

A textbook in the graphic arts that covers all aspects of preparing documents for reading. Emphasis is on the visual elements, including design, typography, images, color, print media, newsletters, magazine and newspaper design, public relations, and television graphics. A concluding section discusses print production and electronic desktop publishing.

Beach, Mark. *Getting It Printed: How to Work with Printers and Graphic Arts Services to Assure Quality, Stay on Schedule and Control Costs.* Rev. ed. Portland, OR: Coast to Coast Books, 1993.

An analysis of printing production steps from planning through delivery. Sections focus on topics such as typesetting, photographs, paper and ink, and printing methods. Chapters include checklists designed to cut production time and monitor quality control and production costs.

Bivens, Thomas, and Ryan, William E. *How to Produce Creative Publications: Traditional Techniques and Computer Applications.* Lincolnwood, IL: NTC Business Books, 1991.

Contains 11 chapters covering fundamentals of writing, design, typography, and photography and illustration. Discusses layout and printing with a separate section for various printed forms. Each chapter is divided into basics and computer applications.

Blair, Raymond, ed. *The Lithographer's Manual.* 7th ed. Pittsburgh, PA: The Graphic Arts Technical Foundation, 1983.

Single volume summary of concise information on all phases of lithography and related subjects.

Carter, Rob; Day, Ben; and Meggs, Phillip B. *Typographic Design: Form and Communication*. New York: Van Nostrand Reinhold, 1985.
Covers typographic heritage and fundamentals, problem-solving approaches, responsible design, legibility factors and type specimens.

Chicago Guide to Preparing Electronic Manuscripts. Chicago: University of Chicago Press, 1987.
From the editors of *The Chicago Manual of Style*. Chapters include instructions to authors, generic coding of electronic manuscripts, notes to publishers, and four appendixes (questionnaires for authors, evaluation forms for typesetters, author checklist, and list of codes).

International Paper Company. *Pocket Pal: A Graphic Arts Production Handbook*. 15th ed. New York: International Paper Company, 1992.
Covers most aspects of publishing from printing to binding in language that is easy to understand. Color separation, halftones, imposition, and practically every other aspect of publishing are described. Revised periodically to reflect developments in the graphic arts.

Kleper, Michael L. *The Illustrated Handbook of Desktop Publishing and Typesetting*. 2nd ed. Blue Summit, PA: TAB Books, 1990.
A comprehensive guide (23 chapters and over 900 pages) on all phases of producing material electronically. Covers type creating input, using electronic means to acquire material, desktop publishing, clip art, typesetting, and production methods. Mentions several software packages and offers suggestions on their uses.

Knuth, Donald E. *The TEXbook*. Reading, MA: Addison-Wesley Publishing Company, 1984.
A handbook about TEX, the typesetting system intended for publications that contain mathematics. Using TEX format, an author or editor can produce computerized mathematical copy comparable to printing.

Lem, Dean Phillip. *Graphics Master 3*. 3rd ed. Los Angeles: Dean Lem Associates, 1983.
A comprehensive, easy-to-use, quick reference source for print production, technical data, and working information. Includes information on typography and color.

Meggs, Phillip B. *Type and Image: Graphic Design, Communication, Marketing, Typography and Advertising Campaigns*. New York: Van Nostrand Reinhold, 1989.
Includes fundamental and advanced information about effective graphic design.

Parker, Robert C. *Looking Good in Print: A Guide to Basic Design for Desktop Publishing*. 2nd ed. Chapel Hill, NC: Ventana Press, 1990.
A textbook that carries the reader through the design and production processes. Chapters on type, graphic design, effective visuals, common pitfalls, and creating a variety of print products.

Pickens, Judy E. *The Copy-to-Press Handbook: Preparing Words and Art for Print*. New York: John Wiley and Sons, 1985.
A comprehensive book covering all phases of turning words and images into print. Includes discussion of bindings and documenting the job. Focus is primarily on getting material ready for offset printing.

Sanders, Norma, and Bevington, William. *Graphic Designer's Production Handbook*. Ardmore, PA: Hastings Books, 1982.
This guide is divided into three categories: preprinting preparation; halftone reproduction in black and white, duotone, and full color; and lithography and finishing operations.

Seybold, John W. *The World of Digital Typesetting*. Media, PA: Seybold Publications, 1984.
Traces the development of typesetting systems. Covers such topics as the composition process, photocomposition, composition and word processing, and computer-aided composition.

Tufte, Edward R. *Envisioning Information*. Cheshire, CT: Graphics Press, 1990.
Extensively illustrates the presentation of information in graphic form.

Tufte, Edward R. *The Visual Display of Quantitative Information*. Cheshire, CT: Graphics Press, 1983.
Presents and illustrates the theory and practice of graphically representing quantitative data.

Van Uchelen, Rod. *Paste-Up: Production Techniques and New Applications*. New York: Van Nostrand Reinhold, 1976.
Discusses the mechanics and function of paste-up at three major skill levels: duplication in the office, professional volume work, and art production. Contains numerous techniques, shortcuts, and tips for paste-up.

Appendix B
Report Documentation Page, Standard Form (SF) 298
and Instructions for Completion

(This appendix is not part of American National Standard for Scientific and Technical Reports — Elements, Organization, and Design, ANSI/NISO Z39.18-1995. It is included for information only.)

REPORT DOCUMENTATION PAGE		Form Approved OMB No. 0704-0188
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503		
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
4. TITLE AND SUBTITLE		5. FUNDING NUMBERS
6. AUTHOR(S)		
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9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSORING / MONITORING AGENCY REPORT NUMBER
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Prescribed by ANSI/NISO Std. Z39.18
298-102

(continued)

ANSI/NISO Z39.18-1995   APPENDIX

Appendix B continued

GENERAL INSTRUCTIONS FOR COMPLETING SF 298

The Report Documentation Page (RDP) is used in announcing and cataloging reports. It is important that this information be consistent with the rest of the report, particularly the cover and title page. Instructions for filling in each block of the form follow. It is important to **stay within the lines** to meet **optical scanning requirements.**

Block 1. Agency Use Only *(Leave blank).*

Block 2. Report Date. Full publication date including day, month, and year, if available (e.g. 1 Jan 88). Must cite at least the year.

Block 3. Type of Report and Dates Covered. State whether report is interim, final, etc. If applicable, enter inclusive report dates (e.g. 10 Jun 87 - 30 Jun 88).

Block 4. Title and Subtitle. A title is taken from the part of the report that provides the most meaningful and complete information. When a report is prepared in more than one volume, repeat the primary title, add volume number, and include subtitle for the specific volume. On classified documents enter the title classification in parentheses.

Block 5. Funding Numbers. To include contract and grant numbers; may include program element number(s), project number(s), task number(s), and work unit number(s). Use the following labels:

C	-	Contract	PR	-	Project
G	-	Grant	TA	-	Task
PE	-	Program Element	WU	-	Work Unit Accession No.

Block 6. Author(s). Name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. If editor or compiler, this should follow the name(s).

Block 7. Performing Organization Name(s) and Address(es). Self-explanatory.

Block 8. Performing Organization Report Number. Enter the unique alphanumeric report number(s) assigned by the organization performing the report.

Block 9. Sponsoring/Monitoring Agency Name(s) and Address(es). Self-explanatory.

Block 10. Sponsoring/Monitoring Agency Report Number. *(If known)*

Block 11. Supplementary Notes. Enter information not included elsewhere such as: Prepared in cooperation with...; Trans. of...; To be published in.... When a report is revised, include a statement whether the new report supersedes or supplements the older report.

Block 12a. Distribution/Availability Statement. Denotes public availability or limitations. Cite any availability to the public. Enter additional limitations or special markings in all capitals (e.g. NOFORN, REL, ITAR).

DOD - See DODD 5230.24, "Distribution Statements on Technical Documents."
DOE - See authorities.
NASA - See Handbook NHB 2200.2.
NTIS - Leave blank.

Block 12b. Distribution Code.

DOD - Leave blank.
DOE - Enter DOE distribution categories from the Standard Distribution for Unclassified Scientific and Technical Reports.
NASA - Leave blank.
NTIS - Leave blank.

Block 13. Abstract. Include a brief *(Maximum 200 words)* factual summary of the most significant information contained in the report.

Block 14. Subject Terms. Keywords or phrases identifying major subjects in the report.

Block 15. Number of Pages. Enter the total number of pages.

Block 16. Price Code. Enter appropriate price codes *(NTIS only).*

Blocks 17. - 19. Security Classifications. Self-explanatory. Enter U.S. Security Classification in accordance with U.S. Security Regulations (i.e., UNCLASSIFIED). If form contains classified information, stamp classification on the top and bottom of the page.

Block 20. Limitation of Abstract. This block must be completed to assign a limitation to the abstract. Enter either UL (unlimited) or SAR (same as report). An entry in this block is necessary if the abstract is to be limited. If blank, the abstract is assumed to be unlimited.

Standard Form 298 Back (Rev. 2-89)

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INDEX

This is a subject index to the conceptual and practical terms of report organization and design. It covers only the standard itself. The front matter and appendixes are not indexed. The index refers readers to section, figure (f.), table (t.), and footnote (n.) numbers, not page numbers. Section numbers referring to passages of significant interest or length are set in bold face type.
Compiled by Patricia J. Case

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NISO Standard Evaluation Form

Standards are intended to be useful. However, information on where, when, and how standards are used, and with what results, is difficult to obtain. The purpose of this form is to provide users of this document with a convenient way to communicate about that use to those responsible for the NISO Standard. Your feedback can have an important effect, not only on future versions of this NISO Standard, but on the way other NISO Standards are created. If you have used (or are planning to use) this NISO Standard in any way, please complete this form and return it at your earliest convenience. Thank you for helping us to improve the NISO Standards you use.

1. **How did you learn about this NISO Standard? (Details are appreciated.)**

    ____ Written citation/reference. Source: _____

    ____ Promotional literature. Type: _____

    ____ Referral from a colleague. Industry: _____

    ____ Other, please specify: _____

2. **Are you using/planning to use this NISO Standard in any way, and to what extent?**

    ____ Full use (unmodified)   ____ Modified use

    ____ Partial use (unmodified)   ____ No use

3. **In what kind of environment(s) will this NISO Standard be used?**

    ____ Governmental   ____ Nonprofit (academic/educational)

    ____ Personal   ____ Nonprofit (other), please specify:

    ____ For profit   _____

4. **During what year will this NISO Standard first be used?** _____

5. **How would you rate this NISO Standard in terms of:**

	Poor	Fair	Good	Very Good	Excellent	No Opinion
Readability	1	2	3	4	5	6
Presentation	1	2	3	4	5	6
Application	1	2	3	4	5	6

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    _____

    _____

    _____

7. **Would you be interested in working on revisions to this NISO Standard or on other NISO Standards in the same area?** ____ Yes ____ No

8. **This form was completed by:**

    Name and title _____

    Organization _____

    Address _____

    City/State/Zip _____

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Please return this form to: **National Information Standards Organization**
P. O. Box 1056
Bethesda, MD 20827
Fax: (301) 654-1721

Other NISO Press Publications

Z39.19-1993

Guidelines for the Construction, Format, and Management of Monolingual Thesauri

This complete update to the bestselling NISO standard on thesaurus structure is the authoritative guide for constructing single-language thesauri, one of the most powerful tools for information retrieval. Z39.19 shows how to formulate descriptors, establish relationships among terms, and present the information in print and on a screen. Included are thesaurus maintenance procedures and recommended features for thesaurus management systems. Extensive examples, suggestions for further reading, and a detailed index complete this outstanding standard.

Z39.23-1990

Standard Technical Report Number (STRN) Format and Creation

This standard defines a unique numbering system that improves access to the wealth of scientific and technical reports issued by the government and private organizations. The STRN is an alphanumeric code with a maximum length of 32; for international application an optional country code can be added. You'll learn how and where the code should be assigned and used.

Z39.41-1990

Printed Information on Spines

This standard describes the recommended formatting for information on the spines of printed bindings, covers, or containers that enclose books, multimedia items, microforms, computer diskettes, CD-ROMs, etc. Definitions, placement of bibliographic data, and typographical arrangement are described and graphic examples are provided.

Z39.48-1992

Permanence of Paper for Printed Publications and Documents in Libraries and Archives

Much of the original published record from the 19th and 20th centuries has been lost because these publications were printed on highly acid, unstable paper. This standard sets the basic criteria for coated and uncoated papers that will last several hundred years under normal use. It covers pH value, tear resistance, alkaline reserve and lignin threshold. Recycled papers will meet the criteria specified.

NISO/ANSI/ISO 12083

Electronic Manuscript Preparation and Markup

In complete conformance with ISO 8879 (SGML-Standard Generalized Markup Language), 12083 provides a toolkit for developing customized SGML applications. Four Document Type Definitions (DTDs) are specified for books, serials, articles, and mathematics. Instructions for the preparation of texts for the near-automatic conversion to grade-2 braille and for publication in large-print and computer voice editions are included.

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National Information Standards Series

Z39.2-1994	Information Interchange Format
Z39.4-1984	Basic Criteria for Indexes
Z39.5-1985	Abbreviation of Titles of Publications
Z39.9-1992	International Standard Serial Numbering
Z39.14-1979 (R1987)	Writing Abstracts
Z39.18-1995	Scientific and Technical Reports — Elements, Organization, and Design
Z39.19-1993	Guidelines for the Construction, Format, and Management of Monolingual Thesauri
Z39.22-1989	Proof Corrections
Z39.23-1990	Standard Technical Report Number (STRN) Format and Creation
Z39.41-1990	Printed Information on Spines
Z39.43-1993	Standard Address Number (SAN) for the Publishing Industry
Z39.44-1986	Serials Holdings Statements
Z39.47-1993	Extended Latin Alphabet Coded Character Set for Bibliographic Use (ANSEL)
Z39.48-1992	Permanence of Paper for Publications and Documents in Libraries and Archives
Z39.50-1995	Information Retrieval (Z39.50): Application Service Definition and Protocol Specification (Version 3)
Z39.53-1994	Codes for the Representation of Languages for Information Interchange
Z39.56-1991	Serial Item and Contribution Identifier
Z39.57-1989 (R1995)	Holding Statements for Non-Serial Items
Z39.58-1992	Common Command Language for Online Interactive Information Retrieval
Z39.62-1993	Eye-Legible Information on Microfilm Leaders and Trailers and on Containers of Processed Microfilm on Open Reels
Z39.63-1989	Interlibrary Loan Data Elements
Z39.64-1989 (R1995)	East Asian Character Code for Bibliographic Use
Z39.66-1992	Durable Hard-Cover Binding for Books
Z39.67-1993	Computer Software Description
Z39.73-1994	Single-Tier Steel Bracket Library Shelving
NISO/ANSI/ISO 3166	Codes for the Representation of Names of Countries
NISO/ANSI/ISO 9660	Volume and File Structure of CD-ROM for Information Exchange
NISO/ANSI/ISO 12083	Electronic Manuscript Preparation and Markup